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October 7, 2003, Tuesday

NATIONAL DESK

Critics Say Execution Drug May Hide Suffering

By ADAM LIPTAK (NYT) 1661 words

NASHVILLE, Oct. 1 -- At the Riverbend Maximum Security Institution here, through a set of double doors next to several vending machines, a gurney stands ready to deliver prisoners to their executions by lethal injection.

Just about every aspect of the death penalty provokes acrimonious debate, but this method of killing, by common consensus, is as humane as medicine can make it. People who have witnessed injection executions say the deaths appeared hauntingly serene, more evocative of the operating room than of the gallows.

But a growing number of legal and medical experts are warning that the apparent tranquillity of a lethal injection may be deceptive. They say the standard method of executing people in most states could lead to paralysis that masks intense distress, leaving a wide-awake inmate unable to speak or cry out as he slowly suffocates.

In 2001, it became a crime for veterinarians in Tennessee to use one of the chemicals in that standard method to euthanize pets.

The chemical, pancuronium bromide, has been among those specified for use in lethal injections since Oklahoma first adopted that method of execution in 1977. Only now, though, is widespread attention starting to focus on it.

Spurred by a lawsuit by a death row inmate here, advances in human and veterinary medicine, and a study last year that revealed for the first time the chemicals that many other states use to carry out executions, experts have started to question this part of the standard lethal injection method.

Pancuronium bromide paralyzes the skeletal muscles but does not affect the brain or nerves. A person injected with it remains conscious but cannot move or speak.

In Tennessee and about 30 other states, the chemical is used in combination with two others. The other chemicals can either ease or exacerbate the suffering the pancuronium bromide causes, depending on the dosages and the expertise of the prison personnel who administer them.

A judge here recently found that pancuronium bromide, marketed under the trade name Pavulon, has "no legitimate purpose."

"The subject gives all the appearances of a serene expiration when actually the subject is feeling and perceiving the excruciatingly painful ordeal of death by lethal injection," the judge, Ellen Hobbs Lyle, wrote, describing the worst-case scenario. "The Pavulon gives a false impression of serenity to viewers, making punishment by death more palatable and acceptable to society."

A simpler and more humane alternative to the three-chemical combination, many experts agree, is the method usually used in animal euthanasia: a single lethal dose of a barbiturate called sodium pentobarbital.

Dr. Sherwin B. Nuland, who teaches medicine at Yale and wrote "How We Die" (Knopf, 1994) said he was baffled to hear that pancuronium bromide was used in executions.

"It strikes me that it makes no sense to use a muscle relaxant in executing people," he said. "Complete muscle paralysis does not mean loss of pain sensation."

Dr. Nuland, who described himself as a cautious supporter of the death penalty, said a humane death could be achieved in other ways, including by using the other two chemicals in the standard method, without the pancuronium bromide.

The challenge to the use of pancuronium bromide was brought in chancery court here by Abu-Ali Abdur'Rahman, who is on death row for a 1986 murder. Judge Lyle wrote that the use of the chemical "taps into every citizen's fear that the government manipulates the setting and gilds the filly." But despite her misgivings, she ruled that the use of the drug did not violate the Constitution's ban on cruel and unusual punishment, because it was widely used and because "there is less than a remote chance that the prisoner will be subjected to unnecessary physical pain or psychological suffering."

The case is on appeal.

Mr. Abdur'Rahman, 52, is being held at the Riverbend prison, along with 92 other death row inmates. He is short and slight, and his long beard has turned gray. He spoke to a visitor through thick glass.

"They're saying I'm less than an animal," Mr. Abdur'Rahman said. "The poison they put into our veins needs to be challenged. Had my attorneys not researched this, I doubt very much it would have come to light."

The American Veterinary Medical Association condemns pancuronium bromide when it is the sole chemical used or when it is used in combination with the usual animal euthanasia drug, sodium pentobarbital. That is because, an association report in 2000 said, "the animal may perceive pain and distress after it is immobilized."

Lethal injection is now the dominant way Americans are executed. It is used in all 38 states that have the death penalty except Nebraska, which uses electrocution. In 10 states, prisoners may choose between lethal injection and a second method, including hanging, firing squad, electrocution and lethal gas.

In most methods of lethal injection, pancuronium bromide is the second drug in a three-chemical

sequence.

The first is sodium thiopental, a so-called ultra-short-acting barbiturate. It can be effective for only minutes. In surgery, it is used to induce rather than maintain anesthesia. Doctors like it because patients who encounter immediate complications awaken quickly enough to be saved.

The third is potassium chloride, which stops the heart and causes excruciating pain if the prisoner is conscious.

"It would basically deliver the maximum amount of pain the veins can deliver, which is a lot," Dr. Mark J. S. Heath, an anesthesiologist who teaches at Columbia, testified at a hearing for Mr. Abdur'Rahman.

One problem with the combination of chemicals, Dr. Heath said in an interview, is that the sodium thiopental could be inadequate or wear off. That would leave the prisoner conscious, paralyzed, suffocating and subject to extreme pain from the potassium chloride.

"You're in a chemical tomb," he said.

The possibility of improper doses or sequences and of bungled injections is increased, Dr. Heath said, because doctors may not take part in executions under most codes of medical ethics.

The reason for pancuronium bromide in the standard lethal injection method is not well understood. Judge Lyle found that Tennessee's method "was developed simply by copying the same method used in some 30 other states."

Deborah W. Denno, a law professor at Fordham University who published a study of the chemicals used in lethal injections last year, said that assembling information for it was difficult.

"The process has been so hidden," said Professor Denno, who described herself as an opponent of the death penalty.

Four states said their protocols for lethal injection were confidential; three said they had none. Except for New Jersey, which does not use pancuronium bromide, all 28 states that supplied Professor Denno with information used the same three-chemical combination. So does the federal government.

"The idea of even having a lethal injection protocol specifying exact chemicals is a very recent phenomenon," Professor Denno said, "and that's only because prison officials have been pressed to provide them. Nobody really knew what chemicals were being used."

The earliest protocol, in Oklahoma, was based on advice solicited by a state senator from a professor in the state's medical school. The professor, Stanley Deutsch, recommended an ultra-short-acting barbituate and a neuromuscular blocking drug like pancuronium bromide.

"I can assure you that this is a rapid, pleasant way of producing unconsciousness," Dr. Deutsch wrote in 1977.

In a recent interview, Dr. Deutsch stood by his initial finding, saying his method does not cause suffering. "They use such a massive amount of the pentothal that I don't think there is any chance

that people will awaken," he said.

Other states, typically acting through their corrections departments and individual prison wardens, apparently copied Dr. Deutsch's advice without subjecting it to independent medical scrutiny.

The prison warden who developed Tennessee's method, for instance, testified that he did not consult with anyone with a medical or scientific background. The warden, Ricky J. Bell, declined to be interviewed.

A spokeswoman for the Tennessee attorney general also declined to comment and directed a reporter to the state's legal papers. They do not defend the use of pancuronium bromide beyond noting that it is widely used and so should not be considered cruel and unusual punishment under the Constitution.

The state's legal papers also argued that the ban on pancuronium bromide in pet euthanasia does not apply to Mr. Abdur'Rahman because he is not a "nonlivestock animal," which the law says includes pets, captured wildlife, exotic and domesticated animals, rabbits, chicks, ducks and potbellied pigs.

Carol Weihrer, who underwent eye surgery in 1998, testified for Mr. Abdur'Rahman at the hearing in May. Anesthesia was administered before the surgery, as was pancuronium bromide to immobilize the eye. But the anesthesia was ineffective. Ms. Weihrer testified that the experience was terrifying and torturous. She could not, she said, communicate that she was awake.

"I remember using every ounce of my strength to try to move," she said.

The surgery went on for hours. She did not suffocate because she was on a respirator.

Ms. Weihrer called the experience "worse than death."

CAPTIONS: Photo: Abu-Ali Abdur'Rahman, a death row prisoner, challenged the use of one chemical in executions. (Photo by Associated Press)(pg. A18)

Chart: "Chemicals Used In Lethal Injections"

Legal and medical experts have recently begun to question the use of pancuronium bromide in lethal injections. The drug paralyzes the skeletal muscles but does not affect the brain, and may leave the prisoner conscious but unable to move or speak. Other chemicals used with it can either ease or exacerbate the suffering.

METHOD OF EXECUTION USED BY STATE

Lethal injection (pancuronium bromide not used)
Lethal injection (pancuronium bromide used with other chemicals)
Lethal injection (chemicals used not available)
Electric chair
No death penalty

Chart shows the number of executions per year by lethal injection, electric chair, firing squad, gas chamber or hanging since 1976.

(Sources by Deborah W. Denno, Fordham University; Death Penalty Information Center)(pg. A13)

TAB 72

2000 Report of the AVMA Panel on Euthanasia



with loss of consciousness progressing to anesthesia. With an overdose, deep anesthesia progresses to apnea, owing to depression of the respiratory center, which is followed by cardiac arrest.

All barbituric acid derivatives used for anesthesia are acceptable for euthanasia when administered intravenously. There is a rapid onset of action, and loss of consciousness induced by barbiturates results in minimal or transient pain associated with venipuncture. Desirable barbiturates are those that are potent, long-acting, stable in solution, and inexpensive. Sodium pentobarbital best fits these criteria and is most widely used, although others such as secobarbital are also acceptable.

Advantages—(1) A primary advantage of barbiturates is speed of action. This effect depends on the dose, concentration, route, and rate of the injection. (2) Barbiturates induce euthanasia smoothly, with minimal discomfort to the animal. (3) Barbiturates are less expensive than many other euthanasia agents.

Disadvantages—(1) Intravenous injection is necessary for best results and requires trained personnel. (2) Each animal must be restrained. (3) Current federal drug regulations require strict accounting for barbiturates and these must be used under the supervision of personnel registered with the US Drug Enforcement Administration (DEA). (4) An aesthetically objectionable terminal gasp may occur in unconscious animals. (5) These drugs tend to persist in the carcass and may cause sedation or even death of animals that consume the body.

Recommendations—The advantages of using barbiturates for euthanasia in small animals far outweigh the disadvantages. Intravenous injection of a barbituric acid derivative is the preferred method for euthanasia of dogs, cats, other small animals, and horses. Intraperitoneal injection may be used in situations when an intravenous injection would be distressful or even dangerous. Intracardiac injection must only be used if the animal is heavily sedated, unconscious, or anesthetized.

Pentobarbital combinations

Several euthanasia products are formulated to include a barbituric acid derivative (usually sodium pentobarbital), with added local anesthetic agents or agents that metabolize to pentobarbital. Although some of these additives are slowly cardiotoxic, this pharmacologic effect is inconsequential. These combination products are listed by the DEA as Schedule III drugs, making them somewhat simpler to obtain, store, and administer than Schedule II drugs such as sodium pentobarbital. The pharmacologic properties and recommended use of combination products that combine sodium pentobarbital with lidocaine or phenytoin are interchangeable with those of pure barbituric acid derivatives.

A combination of pentobarbital with a neuromuscular blocking agent is not an acceptable euthanasia agent.

Chloral hydrate

Chloral hydrate depresses the cerebrum slowly; therefore, restraint may be a problem for some animals. Death is caused by hypoxemia resulting from progressive depression of the respiratory center, and may be preceded by gasping, muscle spasms, and vocalization.

Recommendations—Chloral hydrate is conditionally acceptable for euthanasia of large animals only when administered intravenously, and only after sedation to decrease the aforementioned undesirable side effects. Chloral hydrate is not acceptable for dogs, cats, and other small animals because the side effects may be severe, reactions can be aesthetically objectionable, and other products are better choices.

T-61

T-61 is an injectable, nonbarbiturate, non-narcotic mixture of 3 drugs used for euthanasia. These drugs provide a combination of general anesthetic, curariform, and local anesthetic actions. T-61 has been withdrawn from the market and is no longer manufactured or commercially available in the United States. It is available in Canada and other countries. T-61 should be used only intravenously and at carefully monitored rates of injection, because there is some question as to the differential absorption and onset of action of the active ingredients when administered by other routes.¹

Tricaine methane sulfonate (MS 222, TMS)

MS 222 is commercially available as tricaine methane sulfonate (TMS), which can be used for the euthanasia of amphibians and fish. Tricaine is a benzoic acid derivative and, in water of low alkalinity (< 50 mg/L as CaCO₃); the solution should be buffered with sodium bicarbonate.¹⁰⁴ A 10 g/L stock solution can be made, and sodium bicarbonate added to saturation, resulting in a pH between 7.0 and 7.5 for the solution. The stock solution should be stored in a dark brown bottle, and refrigerated or frozen if possible. The solution should be replaced monthly and any time a brown color is observed.¹⁰⁵ For euthanasia, a concentration ≥ 250 mg/L is recommended and fish should be left in this solution for at least 10 minutes following cessation of opercular movement.¹⁰⁴ In the United States, there is a 21-day withdrawal time for MS 222; therefore, it is not appropriate for euthanasia of animals intended for food.

Potassium chloride in conjunction with prior general anesthesia

Although unacceptable and condemned when used in unanesthetized animals, the use of a supersaturated solution of potassium chloride injected intravenously or intracardially in an animal under general anesthesia is an acceptable method to produce cardiac arrest and death. The potassium ion is cardiotoxic, and rapid intravenous or intracardiac administration of 1 to 2 mmol/kg of body weight will cause cardiac arrest. This is a preferred injectable technique for euthanasia of livestock or wildlife species to reduce the risk of toxicosis for predators or scavengers in situations where carcasses of euthanatized animals may be consumed.^{106,107}

Advantages—(1) Potassium chloride is not a controlled substance. It is easily acquired, transported, and mixed in the field. (2) Potassium chloride, when used with appropriate methods to render an animal unconscious, results in a carcass that is potentially less toxic for scavengers and predators in cases where carcass disposal is impossible or impractical.

Disadvantage—Rippling of muscle tissue and clonic spasms may occur on or shortly after injection.

Recommendations—It is of utmost importance that personnel performing this technique are trained and knowledgeable in anesthetic techniques, and are competent in assessing anesthetic depth appropriate for administration of potassium chloride intravenously. Administration of potassium chloride intravenously requires animals to be in a surgical plane of anesthesia characterized by loss of consciousness, loss of reflex muscle response, and loss of response to noxious stimuli. Saturated potassium chloride solutions are effective in causing cardiac arrest following rapid intracardiac or intravenous injection. Residual tissue concentrations of general anesthetics after anesthetic induction have not been documented. Whereas no scavenger toxicoses have been reported with potassium chloride in combination with a general anesthetic, proper carcass disposal should always be attempted to prevent possible toxicosis by consumption of a carcass contaminated with general anesthetics.

Unacceptable injectable agents

When used alone, the injectable agents listed in Appendix 4 (strychnine, nicotine, caffeine, magnesium sulfate, potassium chloride, cleaning agents, solvents, disinfectants and other toxins or salts, and all neuromuscular blocking agents) are unacceptable and are absolutely condemned for use as euthanasia agents.

PHYSICAL METHODS

Physical methods of euthanasia include captive bolt, gunshot, cervical dislocation, decapitation, electrocution, microwave irradiation, kill traps, thoracic compression, exsanguination, stunning, and pithing. When properly used by skilled personnel with well-maintained equipment, physical methods of euthanasia may result in less fear and anxiety and be more rapid, painless, humane, and practical than other forms of euthanasia. Exsanguination, stunning, and pithing are not recommended as a sole means of euthanasia, but should be considered adjuncts to other agents or methods.

Some consider physical methods of euthanasia aesthetically displeasing. There are occasions, however, when what is perceived as aesthetic and what is most humane are in conflict. Physical methods may be the most appropriate method for euthanasia and rapid relief of pain and suffering in certain situations. Personnel performing physical methods of euthanasia must be well trained and monitored for each type of physical technique performed. That person must also be sensitive to the aesthetic implications of the method and inform onlookers about what they should expect when possible.

Since most physical methods involve trauma, there is inherent risk for animals and humans. Extreme care and caution should be used. Skill and experience of personnel is essential. If the method is not performed correctly, animals and personnel may be injured. Inexperienced persons should be trained by experienced persons and should practice on carcasses or anesthetized animals to be euthanatized until they are proficient in performing the method properly and humanely. When done appropriately, the panel considers most physical methods conditionally acceptable for euthanasia.

Penetrating captive bolt

A penetrating captive bolt is used for euthanasia of ruminants, horses, swine, laboratory rabbits, and dogs.¹⁰⁸ Its mode of action is concussion and trauma to the cerebral hemisphere and brainstem.^{109,110} Captive bolt guns are powered by gunpowder or compressed air and must provide sufficient energy to penetrate the skull of the species on which they are being used.¹⁰⁹ Adequate restraint is important to ensure proper placement of the captive bolt. A cerebral hemisphere and the brainstem must be sufficiently disrupted by the projectile to induce sudden loss of consciousness and subsequent death. Accurate placement of captive bolts for various species has been described.¹⁰⁹⁻¹¹² A multiple projectile has been suggested as a more effective technique, especially for large cattle.¹⁰⁹

A nonpenetrating captive bolt only stuns animals and should not be used as a sole means of euthanasia (see "Stunning" under "Adjunctive Methods").

Advantage—The penetrating captive bolt is an effective method of euthanasia for use in slaughterhouses, in research facilities, and on the farm when use of drugs is inappropriate.

Disadvantages—(1) It is aesthetically displeasing. (2) Death may not occur if equipment is not maintained and used properly.

Recommendations—Use of the penetrating captive bolt is an acceptable and practical method of euthanasia for horses, ruminants, and swine. It is conditionally acceptable in other appropriate species. The nonpenetrating captive bolt must not be used as a sole method of euthanasia.

Euthanasia by a blow to the head

Euthanasia by a blow to the head must be evaluated in terms of the anatomic features of the species on which it is to be performed. A blow to the head can be a humane method of euthanasia for neonatal animals with thin craniums, such as young pigs, if a single sharp blow delivered to the central skull bones with sufficient force can produce immediate depression of the central nervous system and destruction of brain tissue. When properly performed, loss of consciousness is rapid. The anatomic features of neonatal calves, however, make a blow to the head in this species unacceptable. Personnel performing euthanasia by use of a blow to the head must be properly trained and monitored for proficiency with this method of euthanasia, and they must be aware of its aesthetic implications.

Appendix 4

Some unacceptable agents and methods of euthanasia (refer to text for details)

Agent or method	Comments
Air embolism	Air embolism may be accompanied by convulsions, opisthotonos, and vocalization. If used, it should be done only in anesthetized animals.
Blow to the head	Unacceptable for most species.
Burning	Chemical or thermal burning of an animal is not an acceptable method of euthanasia.
Chloral hydrate	Unacceptable in dogs, cats, and small mammals.
Chloroform	Chloroform is a known hepatotoxin and suspected carcinogen and, therefore, is extremely hazardous to personnel.
Cyanide	Cyanide poses an extreme danger to personnel and the manner of death is aesthetically objectionable.
Decompression	Decompression is unacceptable for euthanasia because of numerous disadvantages. (1) Many chambers are designed to produce decompression at a rate 15 to 60 times faster than that recommended as optimum for animals, resulting in pain and distress attributable to expanding gases trapped in body cavities. (2) Immature animals are tolerant of hypoxia, and longer periods of decompression are required before respiration ceases. (3) Accidental recompression, with recovery of injured animals, can occur. (4) Bleeding, vomiting, convulsions, urination, and defecation, which are aesthetically unpleasant, may develop in unconscious animals.
Drowning	Drowning is not a means of euthanasia and is inhumane.
Exsanguination	Because of the anxiety associated with extreme hypovolemia, exsanguination should be done only in sedated, stunned, or anesthetized animals.
Formalin	Direct immersion of an animal into formalin, as a means of euthanasia, is inhumane.
Household products and solvents	Acetone, quaternary compounds (including CCl_4), laxatives, clove oil, dimethylketone, quaternary ammonium products*, antacids, and other commercial and household products or solvents are not acceptable agents for euthanasia.
Hypothermia	Hypothermia is not an appropriate method of euthanasia.
Neuromuscular blocking agents (nicotine, magnesium sulfate, potassiumchloride, all curariform agents)	When used alone, these drugs all cause respiratory arrest before loss of consciousness, so the animal may perceive pain and distress after it is immobilized.
Rapid freezing	Rapid freezing as a sole means of euthanasia is not considered to be humane. If used, animals should be anesthetized prior to freezing.
Strychnine	Strychnine causes violent convulsions and painful muscle contractions.
Stunning	Stunning may render an animal unconscious, but it is not a method of euthanasia (except for neonatal animals with thin craniums). If used, it must be immediately followed by a method that ensures death.
Tricaine methane sulfonate (TMS, MS 222)	Should not be used for euthanasia of animals intended as food.

*Roccal D Plus, Pharmacia & Upjohn, Kalamazoo, Mich.